Screening/Diagnosis for Type 2 Diabetes Mellitus

- The purpose of screening is to identify asymptomatic individuals who are at high-risk or likely to have diabetes or pre-diabetes.
- Screening to detect pre-diabetes (Impaired Fasting Glucose-IFG or Impaired Glucose Tolerance-IGT) and diabetes should be considered in individuals $\geq$ 45 years of age, particularly in those with a BMI $\geq$ 25 kg/m2, and if normal, should be repeated at 3-year intervals.
- Testing should be considered at a younger age or be carried out more frequently in individuals who are/have: 1) Overweight (BMI $\geq$ 25 kg/m2) and have additional risk factors; 2) Habitually physically inactive; 3) A first-degree relative with diabetes; 4) Are members of a high-risk ethnic population (e.g. African American, Latino, Native American, Asian American, Pacific Islander); 5) Delivered a baby weighing > 9 lbs or have been diagnosed with Gestational Diabetes Mellitus (GDM); 6) Hypertensive ($\geq$ 140/90 mmHg); 7) HDL cholesterol level < 35 mg/dl (0.90 mmol/l) and/or a triglyceride level > 250 mg/dl (2.82 mmol/l); 8) Polycystic Ovary Syndrome (PCOS); 9) Previous IGT, IFG, or clinical conditions associated with insulin resistance (e.g. PCOS or Acanthosis Nigricans); 10) History of vascular disease; 11) Medications that cause hyperglycemia—i.e. steroids, etc.; and 12) Psychiatric illness (American Association of Clinical Endocrinologists (AACE) risk factor).
- Providers caring for Native Americans or Alaskan Natives are encouraged to follow the Indian Health Service Standards of Care for Adults with Type 2 Diabetes (2006).
- A fasting plasma glucose test (FPG) is the preferred test to diagnose diabetes in children and non-pregnant adults due to its simplicity and cost effectiveness.
- Use of the A1C for the diagnosis of diabetes is not recommended at this time.
- A FPG result $\geq$ 126 mg/dl on two separate occasions is diagnostic of diabetes. Values of 100 to 125 mg/dl are termed impaired fasting glucose or pre-diabetes. FPG values < 100 mg/dl are considered normal according to both American Diabetes Association (ADA) and AACE Standards/Guidelines.
- Individuals with glucose levels of 144 to 199 mg/dl after a two-hour glucose tolerance test are consider to have Impaired Glucose Tolerance (IGT) or pre-diabetes, even though these individuals do not meet the criteria for diagnosed diabetes.
- Individuals with impaired glucose tolerance can significantly reduce the risk of developing type 2 diabetes through intervention with diet and exercise or Metformin.
- People with psychiatric illness such as schizophrenia are at a greater risk for obesity, type 2 diabetes, metabolic syndrome with dyslipidemia, and hypertension than the general population.

Who should be screened for type 2 diabetes mellitus?

Diabetes screening is recommended for high-risk children and adults who have not previously been diagnosed and who are asymptomatic. Type 2 diabetes is frequently not diagnosed until symptoms appear. Incidence of type 2 diabetes in adolescents has shown a dramatic increase in the last decade. Consistent with screening recommendations for adults, only children and youth at increased risk for type 2 diabetes should be tested. Early detection and treatment can decrease the burden of diabetes.

Who are high-risk individuals?

Adults:

Individuals with one or more major risk factors should be screened. No single risk factor is correlated with a 100 percent risk for type 2 diabetes. The greater the number of major risk factors present, the greater the risk of diabetes. The likelihood of diagnosing type 2 diabetes in a person with no risk factors is very low.

What are the major risk factors?

- First degree relatives with diabetes (parents or siblings)
- Overweight (> 20 percent over desired body weight or Body Mass Index (BMI*) > 25 kg/m2)
- Age greater than 45 years old
- Sedentary lifestyle (habitually physically inactive)
- Other clinical conditions associated with insulin resistance (e.g. polycystic ovary syndrome (PCOS) or Acanthosis Nigricans)
- History of vascular disease
- Dyslipidemia (HDL cholesterol level < 35 mg/dl [0.90 mmol/l]) and/or triglyceride level > 250 mg/dl (2.82 mmol/l)
- Previously identified impaired fasting glucose or impaired glucose tolerance (see below)
- History of gestational diabetes or delivery of a baby over 9 pounds
- Hypertension (> 140/90 mmHg)
- African Americans, Hispanic Americans, Native Americans, Asian Americans, Pacific Islanders
- Psychiatric illness (new addition from AACE)

**Body Mass Index (BMI) = weight in kilograms/(height in meters)2, or*
BMI = weight in pounds x 703/height in inches x height in inches

What are the testing criteria for type 2 diabetes in children?

- Overweight (BMI > 85th percentile for age and sex, weight for height > 85th percentile, or weight > 120 percent of ideal for height)

Plus any two of the following risk factors:

- Family history of type 2 diabetes in first or second-degree relative
- Race/ethnicity (Native American, African American, Latino, Asian American, Pacific Islander)
- Signs of insulin resistance or conditions associated with insulin resistance (Acanthosis Nigricans, hypertension, dyslipidemia, or polycystic ovary syndrome (PCOS))
- Maternal history of diabetes or gestational diabetes mellitus (GDM)

Age of initiation: Age 10 years or at onset of puberty, if puberty occurs at a younger age
Frequency: Every 2 years
Test: Fasting plasma glucose (FPG) preferred
Clinical judgment should be used to test for diabetes in high-risk patients who do not meet these criteria.

When should re-screening be done?

If the initial screening is negative, those over 45 years of age should be re-screened every three years. Multiple risk factors or a high degree of clinical suspicion are indications for shorter intervals between screenings in certain individuals, and/or considering a more sensitive screening test such as a two-hour glucose tolerance test (see below). Children whose initial screening is negative, but are at high risk for development of type 2 diabetes, should be screened every two years utilizing FPG testing.

What screening tests should clinicians use?

The FPG test is the preferred screening test for asymptomatic individuals because it is convenient and inexpensive. Fasting is defined as no consumption of food or caloric beverage for at least eight hours prior to testing.

The *oral glucose tolerance test* (OGTT) is also appropriate for screening, but is less convenient and more expensive than a FPG. The OGTT is a more sensitive test for type 2 diabetes and other states of impaired glucose metabolism, and should be considered when the FPG is negative, but the clinical suspicion for abnormal glucose metabolism is high. The DECODE study found that the two-hour value on OGTT correlated better with risk of both cardiovascular and all-cause mortality than did the FPG. Data from the Diabetes Prevention Program indicates that individuals with impaired glucose tolerance can significantly reduce the risk of developing type 2 diabetes through intervention with diet and exercise or Metformin.

Random plasma glucose can be used as a non-diagnostic screening test. A random test is any plasma glucose test obtained without regard to the time since the meal. A level of > 160 mg/dl should be interpreted as abnormal and > 200 is a provisional diagnosis of diabetes. A subsequent elevated FPG or OGTT result is needed to confirm the diagnosis of diabetes.

If an individual has *symptoms of diabetes* (increased thirst, increased urination, unexpected weight loss) and has a *random plasma glucose* > 200 mg/dl, the diagnosis needs to be confirmed on a subsequent day by measurement of FPG, 2-hour OGTT, or a second random plasma glucose.

A1C is not recommended by the American Diabetes Association as a screening test because of inter-laboratory variability and the absence of established cut-off values for the normal range of results. Patients with diabetes may have normal A1C values, and such a result does not rule out diabetes. Elevated A1C results, although not diagnostic, are strongly suggestive of diabetes.

Whole blood glucose testing, finger stick or venous blood, is not recommended for screening or diagnostic testing. Results are usually 10 to 15 percent lower than plasma glucose levels and much less accurate if obtained by a home blood glucose monitoring device.

How should FPG and OGTT results be interpreted?

Screening test results fall into three categories: diabetic, impaired, or normal.

For fasting plasma glucose:

- Diabetic range is defined as FPG > 126 mg/dl
- Impaired fasting glucose is defined as FPG > 100 mg/dl, but < 126 mg/dl
- Normal fasting glucose is < 100 mg/dl (ADA and AACE)

For the OGTT (75-g oral glucose tolerance test):

- Diabetic range is defined as a two-hour post-load glucose value > 200 mg/d
- Impaired glucose tolerance or pre-diabetes is defined as two-hour values > 140 mg/dl, but < 200 mg/dl
- Normal range is two-hour post-load value < 140 mg/dl

What action should be taken based on screening test results?

An elevated result requires retesting on a different day to confirm the diagnosis. A second elevated result confirms the diagnosis of diabetes.

Impaired fasting glucose or *impaired glucose tolerance* are major risk factors for the development of diabetes. The interval between the next screening should be no greater than three years. Lifestyle treatment may be appropriate. Intervention with diet and exercise, or Metformin, can significantly reduce the risk of developing type 2 diabetes.

If test results are normal, the interval between the next screening should be no greater than three years if other major risk factors persist.

What medications can produce hyperglycemia and result in false positive screening results?

Glucocorticoids, furosemide, thiazides, estrogen containing products, ß-blockers, and nicotinic acid may produce hyperglycemia.

Is screening recommended for type 1 DM?

Screening for type 1 diabetes is not recommended because the incidence is too low to justify the expense, the interval between insulin failure and acute symptoms is short, there is no consensus on appropriate interventions for the “prediabetic” phase, and normal levels for autoantibodies related to type 1 diabetes have not been established. Screening for gestational diabetes is covered in a separate section of this manual.

Why are patients with psychiatric illness at risk for type 2 diabetes?

People with psychiatric illness, such as schizophrenia, are at a greater risk of obesity, type 2 diabetes, metabolic syndrome with dyslipidemia, and hypertension than the general population. Data from recent clinical trials documents an increased incidence of cardiovascular disease (CVD) as well as a high prevalence of undiagnosed and untreated metabolic disease (obesity, glucose homeostasis disorders, and dyslipidemia) in patients with severe mental illness who are prescribed antipsychotic drugs. Clinical evidence data links the use of certain second-generation anti-psychotics and increased risk of developing metabolic syndrome and CVD.

The problem represents a major public health issue with multiple causative factors such as lifestyle factors, inequalities in the provision of healthcare, and medication-related adverse effects. In addition, smoking, poor diet, reduced physical activity, and alcohol or drug abuse are prevalent in people with schizophrenia, and contribute to the overall CVD risk. Increasing evidence suggests that having a diagnosis of schizophrenia per se may be a risk factor for development of diseases with metabolic disorders. Management and minimization of metabolic risk factors are pertinent when providing optimal care to patients with schizophrenia. Health care practitioners are encouraged to develop a plan of care that includes ongoing assessment, monitoring, and management of clients with schizophrenia and psychiatric illness.

Why does the Indian Health Service have their own Standards of Care for patients with type 2 diabetes?

The Indian Health Service has developed guidelines specific to the Native American and Alaskan Native population to address the unique aspects of diabetes care delivered in a culturally sensitive manner. Although many of the criteria are consistent with those of the American Diabetes Association, some differences exist including the following: 1) Three plasma blood tests when establishing the diagnosis of diabetes; 2) Use of A1Cs are not recommended for the diagnosis of diabetes; 3) Provision of wholistic (care of the whole person) care; and 4) Screening for depression, cancer, tobacco use, tuberculosis, nonalcoholic fatty liver, anemia, and alcohol and drug abuse. The overall goal for treatment is to ensure consistent quality care to everyone. The 2006 Guidelines are available at http://www.ihs.gov/MedicalPrograms/diabetes/IHSDiabetesStandardsofCare2006.pdf.

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